Comparing total costs of ownership between a b-209 vs. a pa-112

We will calculate and compare the total cost of ownership for both models, considering:

Model b-209:

- **Initial Cost:** $1,158
- **Lifespan:** 6 years (replaced 2 times over 12 years)
- **Annual Energy Cost:** $400

Model pa-112:

- **Initial Cost:** $667
- **Lifespan:** 2 years (replaced 6 times over 12 years)
- **Annual Energy Cost:** $400

Both costs are adjusted for annual inflation at 3%. Now let's analyze the costs in detail:

1. Total Cost Calculation for Model b-209

Years 0-12:

- **Initial Cost (Year 0):** $1,158

- **Replacement Cost (Year 6):** $1,158 \times (1 + 0.03)^6 \approx$ 1,380.49

- **Annual Energy Costs (12 years):**
  $\sum_{i=0}^{11} 400 \times (1 + 0.03)^i \approx 5,713.26$

Total Cost for b-209:
$1,158 + 1,380.49 + 5,713.26 = 8,251.75$

2. Total Cost Calculation for Model pa-112

Years 0-12:

- **Initial Cost (Year 0):** $667

- **Replacement Costs:** Replaced 5 times (Years 2, 4, 6, 8, 10). Each replacement is inflation-adjusted:

  $667 \times (1 + 0.03)^2 \approx 708.47$
  $667 \times (1 + 0.03)^4 \approx 752.76$
  $667 \times (1 + 0.03)^6 \approx 799.71$
  $667 \times (1 + 0.03)^8 \approx 849.46$
  $667 \times (1 + 0.03)^{10} \approx 902.10$

Total Replacement Costs:
$$708.47 + 752.76 + 799.71 + 849.46 + 902.10 \approx 4,012.50$$

- **Annual Energy Costs (12 years):** $5,713.26

Total Cost for pa-112:
$$667 + 4,012.50 + 5,713.26 = 10,392.76$$

3. Calculation of Maximum Interest Rate

If the b-209 is financed (with an initial cost of $1,158) to avoid the "cash drain" caused by paying upfront for multiple pa-112 units, the maximum annual interest rate can be calculated as follows:

- **Financed Cost (pa-112):** $10,392.76
- **Upfront Cost (b-209):** $8,251.75
- **Horizon:** 12 years

The formula for the maximum interest rate is:

$$(1+r)^{12} = \frac{\text{Financed Cost}}{\text{Upfront Cost}}$$

Solving for (r):

$$r = \left(\frac{10,392.76}{8,251.75} \right)^{\frac{1}{12}} - 1 \approx 1.94\%$$

Conclusion

- **Total Cost for b-209:** $8,251.75
- **Total Cost for pa-112:** $10,392.76
- **Maximum Annual Interest Rate for Financing b-209: 1.94%**

This means that, when financing the b-209, as long as the annual interest rate is **less than or equal to 1.94%**, it would be more economical to finance this model rather than purchasing multiple pa-112 units upfront.

However, this model strictly considers observable costs, such as tariffs and energy consumption.

If other components are added to the equation, such as the opportunity cost, known as the "invisible cost" for economists, measured by the productivity differential provided by a high-end aerator compared to a low-end one, alongside the high risk of supply chain disruption whenever a replacement is required due to unforeseen equipment failure, or the customs and transportation logistics associated with replacing the less durable aerator, the disparity between the two models would be even greater.

Therefore, an interest rate that considers not just accounting items but also risk propensity for shrimp farm investors and Pareto-efficient frontiers would likely be significantly higher to equalize the two models.

Evolution of Ownership Costs for 6-Year vs. 2-Year Aerators